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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/669,063	09/23/2003	Mohamad A. Shaheen	42P15990	2742

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EXAMINER

TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 12/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/669,063	SHAHEEN, MOHAMAD A.	
	Examiner	Art Unit	
	Binh X. Tran	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) 15-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 21-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-29 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-14, 21-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thilderkvist (EP 1 085 562 A2) in view of Leitz et al. (US 2002/0197803 A1).

Respect to claim 1, Thilderkvist discloses a method comprising the steps of:

forming a silicon germanium layer on the substrate (paragraph 0033, 0045);

removing, in the processing chamber, a portion of silicon germanium layer (exposing to etchant gas) (See paragraph 0048-0049);

smooth a surface of silicon germanium layer (i.e. heating at 1000-1300 °C) in the processing chamber (paragraph 0047);

forming a silicon layer on the smooth surface of the silicon germanium layer (Figure 1 step 108, paragraph 0053, 0068).

Thilderkvist fails to disclose that the silicon germanium is also formed in the same processing chamber. However, Thilderkvist clearly it is teaches to form the silicon film in the same process chamber using chemical vapor deposition technique (paragraph 0068). Leitz teaches to form silicon germanium in the process chamber using chemical vapor deposition technique (paragraph 0029-0030). It would have been

obvious to one having ordinary skill in the art, at the time of invention, to modify Thilderkvist in view of Leitz by forming the initial silicon germanium layer in the same processing chamber in order to save cost, processing time on wafer handling and in order to avoid contamination during wafer handling. Further, this would also be possible with the processing chamber in Fig 2A of Thilderkvist because both references use chemical vapor deposition chamber.

Respect to claim 2, Thilderkvist teaches the substrate is not removed from the processing chamber until after the silicon layer is formed (Fig 1). Respect to claim 3, Thilderkvist teaches to keep the chamber under vacuum by using a pump to create reduced pressure during the removal of a portion of silicon germanium layer until after the completion of formation of the silicon layer (paragraph 0032).

Respect to claims 4, 21, Leitz discloses the step of: forming a first layer of silicon germanium (12) on a silicon substrate, wherein the first layer (12) has an increase in concentration of germanium with respect to one direction from the substrate (paragraph 0030), forming a second layer (14) of silicon germanium on the first layer (12) of silicon germanium, wherein the second layer has a constant concentration of germanium throughout a thickness of the second layer (paragraph 0030, Fig 1). It would have been obvious to one having ordinary skill in the art, at the time of invention, to form two different silicon germanium layers and etching the second layer because it will enhance the performance of the hetero-structure device by using silicon germanium as carrier mobility. The limitation of claims 22-23 has been discussed above.

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Respect to claims 5 and 24, Leitz teaches to increase the concentration of germanium in the first layer so that the concentration of germanium increases by 10% per micron of the thickness (paragraph 0030).

Respect to claims 6 and 25, Leitz discloses that the concentration of the second layer (14) is 20%. Leitz also teaches first layer has a thickness of 2-9 micron and the concentration increase by 10% per micron. When the thickness of the first layer equals to 2 micron, the concentration in the upper portion of the first layer would be 20% (10 % per micron x 2 micron = 20%). Base on this information, the concentration of germanium in the second layer is the same as the concentration of the first layer in the upper portion.

Respect to claim 7, Leitz teaches the second layer is formed to a thickness between 0.2-2 μm (paragraph 0030, overlap with applicant's range). Respect to claims 8-9, 26-27, Thilderkvist teaches to use HCl or HBr etchant to remove silicon germanium layer.

Respect to claim 10, Thilderkvist teaches to use either silicon or silicon germanium film (paragraph 0045). Thilderkvist further teaches the removal amount of this film is about 100 nm (paragraph 0050; Note 100 nm = 0.1 micron). Respect to claim 11 and 28, Thilderkvist teaches the smooth a surface of the silicon germanium follows the removing a portion of the silicon germanium layer wherein the smooth comprises introducing a smoothing agent (col. 11 lines 5-10, col. 18 lines 38-52).

Respect to claims 12-13, 29, Thilderkvist teaches to use hydrogen smooth agent at the

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the temperature between 1000-1300 °C, preferably between 1050-1200 ° C, 1100 °C to smooth the silicon germanium surface (abstract and paragraph 0045, 0047, 0050).

Respect to claim 14, Thilderkvist fails to explicitly disclose the specific thickness ranges for the silicon layer. However, Thilderkvist clearly teaches the silicon film can be formed having any thickness (paragraph 0053). The result effective variable is commonly determined by routine experiment. Thickness is a result effective variable. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal thickness as an expected result.

Response to Arguments

3. The applicant's amendment filed on 10-11-2005 overcame the 35 USC 112, 1st paragraph rejection. Thus, the examiner withdraws the 35 USC 112, 1st paragraph rejection
4. Applicant's arguments filed 10-11-2005 have been fully considered but they are not persuasive.

The applicants argues that "Leitz teaches forming a silicon germanium layer (see paragraph 30), but the Patent Office has not identified, and Applicant is unable to find any teaching in Leitz of removing or smoothing as claimed". This argument is not commensurate with the ground of rejection. The examiner never states that Leitz teaches the step removing and smoothing step as claimed. Instead, the examiner

clearly shows that Thilderkvist discloses both removing and smooth step (See rejection as discussed above).

The applicants further argue that "the combination of Leitz with Thilderkvist would not motivate one having ordinary skill in the art the use the same chamber, as required by claims 1 and 21". Specifically, applicants argue that Thilderkvist teaches against forming the silicon germanium substrate in the same process chamber that used to remove and smooth because Thilderkvist teaches placing a substrate in the chamber. The examiner disagrees. The examiner acknowledges that Thilderkvist teaches placing a substrate in the chamber. However, teaching one way does not mean teaching away. Further, Thilderkvist discloses the removing and smooth process can be performed in same chamber with the depositing of silicon film by using chemical vapor deposition technique (paragraph 0053, 0068). Leitz clearly teaches to form a silicon germanium substrate in the chamber using chemical vapor deposition (paragraph 0029-0030). Since, both Thilderkvist and Leitz teaches to use chemical vapor deposition chamber, it would be obvious to use the same process chamber in order to save cost and processing time.

Respect to claims 11 and 28, the applicants argue that "Thilderkvist teaches a combined gas [HCl and H₂] to perform removing and smooth at the same time, however the Patent Office has not identified, and Applicant is unable to find any teaching in Thilderkvist of smoothing following removing, as claimed". The examiner disagrees with the argument. First, the examiner recognizes that Thilderkvist teaches to use HCl and H₂ gas for both removing and smooth process. However, in col. 10 lines 54-55,

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Thilderkvist states, "since high removal rates use shorter times of etching, the smoothing is not good". Thus, Thilderkvist recommends using two different steps, the first step of high HCl:H₂ concentration for providing high removal rate and a second step of low HCl:H₂ for smoothing the surface (col. 11 lines 5-10, col. 18 lines 38-52).

Therefore, the examiner maintains that Thilderkvist clearly teaches the smoothing step (second step) follows the removing step (first step).

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

DUY-VU N. DEO
PRIMARY EXAMINER

[Signature]
12/21/05